

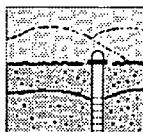
Portland Harbor Sediment Superfund Site
Technical Memorandum:
Results of Seep Reconnaissance Survey
River Mile 2 – 10.5
Lower Willamette River

DRAFT
February 18, 2003

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1.0 INTRODUCTION

This document summarizes the results of a boat reconnaissance survey of groundwater seeps conducted by the Lower Willamette Group (LWG) along the lower Willamette River between River Miles (RM) 2 and 10.5. The U.S. Environmental Protection Agency (EPA) approved the seep reconnaissance on September 20, 2002 as part of an interim scope of work to be conducted for the Round 1 remedial investigation/feasibility study (RI/FS) field data collection activities prior to EPA approval of the draft RI/FS Work Plan. This work was completed to comply with the Administrative Order on Consent USEPA Docket No: CERCLA-10-2001-0240.

The scope of the approved seep reconnaissance work as described in the September 20, 2002 EPA letter included:

1. Perform a boat reconnaissance survey to identify bank seeps within the Initial Study Area (ISA).
2. Photograph, describe and record the location of each seep with a global positioning satellite (GPS) instrument.

The objective of the seep survey is to inventory readily identifiable groundwater seeps present between RM 2 and RM 10.5 for human health risk assessment and groundwater conceptual model development purposes. The intended uses of the seep survey include the following:

1. *Identify groundwater seeps in areas where potential human contact could occur, as discussed in the June 7, 2002 RI/FS Work Plan:* Identifying seeps at beaches that have been identified as potential human use areas is necessary to assess whether potential human contact with groundwater could occur. If a seep is present in a beach identified as a potential human use area, then exposure to groundwater could be possible at that specific beach. When a seep is identified within a beach identified as a potential human use area, the next step to evaluate potential human health risks associated with exposure to groundwater will be assessing whether a potential upland source of groundwater contaminants exists near the beach.
2. *Provide information to describe shallow groundwater interactions with the river for development of a groundwater conceptual model within the ISA:* Information from the seep survey also will be used to assess the relationships between shallow groundwater in the upland areas bordering the ISA and the river to develop a conceptual model of shallow groundwater flow as part of the groundwater data evaluation task of the RI/FS.

The LWG conducted the reconnaissance survey on October 7 and 8, 2002. Representatives from the Oregon Department of Environmental Quality (DEQ) and the EPA accompanied representatives of the LWG on a subsequent tour of the identified seep areas on October 24, 2002. The results of the survey are summarized in the following sections.

2.0 METHODOLOGY

2.1 General Procedures

Representatives from Striplin Environmental Associates (SEA), Groundwater Solutions, Inc. (GSI) and Kennedy Jenks Consulting (KJC) conducted the seep reconnaissance using an outboard motor-powered launch owned and operated by Fishman Environmental. The survey was conducted by cruising close to the shoreline at low speeds while observing the banks for signs of groundwater seepage. The boat was stopped, and in some cases beached, where potential seep locations were observed. GPS coordinates, a description and a photo of the potential seep were obtained at each seep or potential seep location. In addition, navigation points were obtained with a GPS at approximately 5-minute time intervals to delineate the survey route. The seep locations and navigation waypoints illustrating the route of the survey are shown on Figure 1. The locations of beaches that were identified as potential human use areas at or near where seeps were identified are shown on Figure 1. Figure 1 does not include other beaches identified as potential human use areas where seeps were not observed.

The reconnaissance survey was conducted during a low stage period on the Willamette River after a drier than normal summer and fall. The rationale for conducting the survey during low tide periods and during the seasonal low stage levels was to increase the likelihood of observing seeps because more bank and beach would be exposed. Each day's reconnaissance trip was timed to bracket the afternoon low tides, which were at approximately 4:15 pm and 4:55 pm on the respective days of the survey. The October 7 stage level at the afternoon low tide was 2.5 feet and the preceding high was 5.9 feet above sea level (NGVD29) at the Morrison Street Bridge Gage, for a tide differential of 3.4 feet. The afternoon low tide stage level on October 8 was 2.8 feet and the preceding high was 6.4 feet for a differential of 3.6 feet. The Morrison Street Gage is located at approximately RM 12.8, or 2.3 miles upriver from the survey area.

2.2 Seep Identification Criteria

By definition, groundwater is subsurface water that occurs in soil and geologic formations that are fully saturated (Freeze and Cherry, 1979). For the purposes of the seep survey, water from the following sources is considered groundwater:

- Discharge of groundwater from the regional or local shallow groundwater flow system;
- Return flow from tidally-influenced bank storage where it cannot definitively be discriminated from other groundwater discharges;
- Perched groundwater;
- Water seeping through utility backfill.

For the purposes of this survey, a seep is defined as a location where water discharges from the ground either above or below the river surface. The definition of seep does not imply that the water from the seep is contaminated in any way absent some other obvious

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indicator of contamination (e.g., sheen or chemical odor). Seeps were identified during the survey based on at least one of the following criteria:

1. Locations where seepage of water was directly observed;
2. Known past and current locations of petroleum, creosote and other types of NAPL-containing seeps;
3. Locations where water was observed discharging from the backfill surrounding an outfall;
4. Locations where extensive iron (ferric hydroxide) staining of the bank materials was observed; these locations were considered potential seasonal seep locations.

Locations where healthy and/or phreatophyte vegetation also were noted as potentially indicating the presence of groundwater near the surface.

Each seep identified during the survey was visually examined for indications of contamination including discoloration, sheen or obvious odor. Many seeps observed during the survey were characterized by the presence of reddish -orange staining from iron mineral precipitates interpreted to be ferric hydroxide. Iron bacteria slime growth also was commonly observed associated with seeps. The presence of iron-related staining and bacterial growth in the vicinity of seeps is considered diagnostic of the presence of groundwater except in a few situations where the obvious source of the staining is corrosion of steel pipes. Iron is relatively soluble in groundwater where a neutral to reducing environment with a pH range of between 6 and 8 is present, which is common in shallow groundwater in the Portland Basin. Where the water containing iron becomes oxidizing due to exposure of the water to air (e.g., at the seepage interface), the iron solubility decreases and ferric hydroxide precipitates (Hem, 1985). This type of water is typically clear when it initially is exposed to oxygen. The precipitating ferric hydroxide may eventually cause the water to become cloudy (Hem, 1985). However, the presence of staining from iron mineral precipitates does not imply that the narrative water quality standards in OAR 340-041-0445 for discharge of waters containing iron into the Willamette River are being exceeded as the iron is likely naturally-occurring in most cases.

The locations where water was observed discharging directly from outfall pipes were not classified as seeps because of the uncertainty as to whether or not the source of the water was directly from groundwater or was surface drainage from upland sites. Descriptions of general types of seeps observed during the reconnaissance survey are provided in the following section. Table 1 provides the locations and descriptions of specific seeps catalogued during the reconnaissance survey; brief descriptions of the riverbank along the reconnaissance survey route between seep locations, and the seep category, as defined in the following section, for the catalogued locations. Digital photographs of the seep locations with brief captions are provided in Attachment A. The photo locations are shown on Figure 1.

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3.0 RESULTS

3.1 Seep Categories

The types of seeps and potential seeps observed during the survey were categorized according to one or more of the five types described in this section. The types are intended to be generalized descriptors of the types and occurrences of seeps observed and are not an exact and definitive classification as several of the seeps observed during the survey could be considered to have characteristics of more than one of the categories described below.

1. Seepage Line at the Base of Embankments

This type of seep is the most common along the ISA and is characterized by linear seepage of groundwater along the base of steep slopes or embankments. A line of thick, healthy verdant vegetation, including phreatophytes such as cattails, typically delineates the slope break at the base of the embankments. Where observed, the seepage is often distinguished by shallow sheetflow from broad, linear sources with occasional points of higher seepage. Development of rills is observed at some locations, particularly where flow is concentrated and/or underlying soil materials are loose and relatively erodible. Where sand or other granular materials are present on the beach, groundwater may not actually appear on the surface. Seepage was observed to reinfiltrate into the coarse, granular materials before reappearing further down slope where the sand or gravel pinches out near water's edge at several locations (Category 2 seep). Ferric hydroxide staining and iron bacterial slime growth was observed at many locations where surface seepage occurs at the base of the embankment.

This category of seep likely is a manifestation of seepage of shallow groundwater where the water table intersects the ground surface at the base of the embankments. Riprap, docks and retention structures likely obscure occurrences of this type of seep along much of the ISA. While this category of seep is most common, the rate of seepage observed, even in the more laterally-extensive occurrences, is relatively low due to the presence of fine-grained soils at the locations of the seeps observed. Seepage rates were visually estimated to be typically less than 1 gpm, although overall rates may be as high as 5 gpm across the entire length of several laterally-extensive seeps.

2. Linear and Point Seeps at the Foot of Beaches

This type of seep is a result of flow along the interface between overlying granular materials and underlying fine-grained (silt and clayey) sediments, and occurs where coarse, granular materials pinch out near the foot of the beach. The origin of this type of seep in many cases appears to be water flowing from the base of the embankment at the head of the beach through the granular beach materials where it is forced to the surface by the pinching out of more permeable soils. The seepage rates observed for this category were low: less than 1 gpm in most cases. The location of the transition from granular to fine-grained materials at the foot of beaches where the seepage occurs is often below high river stage and high tide levels. At locations where the previous high tide level was above the toe of the sand beach and sand becomes saturated, this type of seep may be in part return flow from drainage of river water temporarily retained within the sand. Ferric hydroxide staining was observed at some locations of this type of seep, particularly where rills have formed from point seepage.

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Water from seeps where ferric hydroxide staining is present is interpreted to be mostly, if not entirely comprised of groundwater, rather than surface water return flow.

3. Backfill Surrounding Outfalls

Locations where seepage from backfill surrounding an outfall pipe was directly observed and where it has been observed in the past (based on DEQ files and communications with City representatives) were included in this category. This type of seep is commonly characterized by ferric hydroxide oxide staining and iron bacterial slime growth on the surrounding soil. The volumetric contribution of this type of seep likely is not great relative to the overall discharge of groundwater to the ISA; however, the mechanism of this type of seep is important for transport of contaminants to the river where groundwater contamination is intersected by utility backfill of a greater permeability than the surrounding soils.

4. Seepage of Nonaqueous Liquids

This category includes the locations of known seeps of nonaqueous phase liquids (NAPL), based on interviews with DEQ project managers and review of DEQ files. This category includes the McCormick & Baxter Creosoting Site (Photo 11), and the Port of Portland Terminal 4, Slip 3 (Photo 13) seeps. Evidence of NAPL seepage at either site was not observed during the survey. The seepage of fuel oil from Terminal 4, Slip 3, when active, appears to occur at the interface between the shallow groundwater surface and the river, which is obscured within the matrix of cobble-sized riprap behind wood pilings. In contrast, the seepage of creosote at the McCormick & Baxter site occurs in submerged shallow areas. Sheens also have been observed in the past associated with several of the seeps catalogued under Category 3, including at the Willbridge Bulk Fuel Terminal where storm drain backfill has acted as a preferential pathway.

5. Potential Seasonal Seep Locations

The locations of potential seasonal seeps were identified on the basis of ferric hydroxide staining of riverbank or beach materials. The presence of ferric hydroxide staining is considered an indicator of possible groundwater seepage in most instances because groundwater is more likely to have the dissolved iron content necessary to produce the observed staining than surface water runoff. A few locations where significant ferric hydroxide staining was observed associated with shallow (e.g., above the water table) and/or steel outfalls that were not flowing were not categorized as potential seeps because of the uncertainty associated with the origin of the staining in these situations.

3.2 Conclusions

The conclusions from the seep survey can be summarized as follows:

- Approximately 17 miles of riverbank were surveyed during the seep reconnaissance. Fifty locations of visible or potential seasonal seepage were identified during the survey. Of these, 42 were identified on the basis of visible seepage at the time of the survey. The other 8 were identified as potential seep locations on the basis of iron (ferric hydroxide) staining of bank materials.
- Iron (ferric hydroxide) staining associated with seepage appears to be diagnostic of the presence of groundwater in most cases, yet is not necessarily an indicator that contaminants of potential concern (COPCs) are present.

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- None of the seeps catalogued during this low water survey displayed visual signs of contamination (e.g., sheen) in the water although hydrocarbon staining was observed on the bank adjacent to two sites (Terminal 4, Slip 3 and the McCormick & Baxter Site). Containment and sorbent booms were present at several locations with historical NAPL seepage including (1) Terminal 4, Slip 3, (2) McCormick & Baxter, and (3) two Willbridge Bulk Terminal sites. However, the seeps catalogued at these locations during this survey were already known to the LWG and are being addressed through upland source control measures. Active containment measures for NAPL associated with seepage around outfalls at Willbridge and the seep at the Terminal 4, Slip 3 site have been implemented under ODEQ cleanup oversight. No other indications of contaminated seeps were found during this survey.
- Seeps were observed at or near 12 beaches that have been identified as potential human use areas (LWG Round 1 Field Sampling Plan, 2002). Each location will be assessed for the presence of a potential nearby upland source of groundwater COPCs as the next step in evaluating potential human health risks associated with groundwater.
- Bank storage return flow may comprise a portion of the water originating from a number of seeps that occur below the level of the high tide preceding the survey observations. However, upland groundwater appears likely to comprise all or a significant portion of the flow at the locations catalogued during the survey.
- A majority of the seeps observed during the survey originate in fine-grained soils (silt and clay), which border much of the ISA. As a result, the relative magnitude of flow observed from the seeps was low (estimated to be less than 1 gpm in many cases). Volumetrically, it is likely that groundwater discharging to the river below the river surface exceeds the discharge from the seeps observed during the survey as higher permeability materials (silty sand and sand) are present adjacent to the ISA and underneath much of the shallow fine-grained soils. The higher permeability materials are present well below the river surface on average.
- Seepage surrounding some outfalls located within fine-grained soil bordering the ISA confirms the potential for preferential groundwater flow along higher permeability backfill.
- Most seeps observed during the survey appear to be expressions of shallow groundwater discharging to the ISA either through fine-grained fill and native soil or utility backfill. The relatively low flow rates observed indicates that the seeps contribute a small percentage of groundwater flow to the river. Furthermore, it is likely that groundwater discharge to the river represents a small percentage of overall input to the river system within the ISA.

The seeps catalogued during this survey are limited to those that could be directly observed or were previously known at the time of the survey. There are likely areas of seepage that were not observed during the survey because of the presence of piers, bulkheads, riprap, dense vegetation, and other access constraints. Also, while the observed seeps are visible expressions of groundwater flow, the discharge represented by the seeps is likely to comprise only a small percentage of the total groundwater discharge to the Portland Harbor with most

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of the groundwater discharging to the river probably occurring as submerged seepage. The use of the information from the seep survey should be limited to assessing locations where potential human exposures to groundwater could occur and understanding an element of shallow groundwater interactions with the river to assist in development of a detailed groundwater conceptual model for the ISA. Thus, the recommended next steps based on the seep survey data are to incorporate the survey results in a detailed groundwater conceptual model for the ISA and to identify where COPCs are present in groundwater in the vicinity of potential human use beaches where seeps were identified.

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Table 1
Seep Survey Summary for River Mile 2 to 10.5
Portland Harbor Sediment RI/FS
Lower Willamette Group, Portland, Oregon

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
1	10/7/2002	7636616.638	699235.6325	Beach No. 09B028. East side of Swan Island Lagoon.	Sandy beach with line source of sheetflow 6 - 8' long near where silty/clayey sediments crop out at base of beach. iron (ferric hydroxide) staining on beach around seep. Below high tide level.	2	Beach with steep vegetated bank behind. Sand and coarser sediments/debris on bank overlying silty/clayey sediment layer at foot of bank
2	10/7/2002	7636482.417	699320.0481	Beach No. 09B028. East side of Swan Island Lagoon.	Rill formation from rivulet - some flow from steep bank above riverbank Seepage in part above and in part below high tide level.	1, 2	Beach with steep vegetated bank behind. Sand and coarser sediments/debris on bank overlying silty/clayey sediment layer at foot of bank
3	10/7/2002	7636343.213	699401.1129	Beach No. 09B028. East side of Swan Island Lagoon.	Linear seep line approximately 10' long behind pier above high water mark. Associated vegetation line on bank. Origin above high tide level.	1, 2	Beach with steep vegetated bank behind. Sand and coarser sediments/debris on bank overlying silty/clayey sediment layer at foot of bank
4/5	10/7/2002	7635514.503	700070.4523	Beach No. 08B034. South of Fred Devine Salvage Pier.	Linear discharge along est. 20' length and approximately 6 - 8' inland of river level. Seepage occurring on top of clayey material cropping out toward base of beach. Some rill formation from base of bank. Mostly below high tide level and in part above.	1, 2	Beach with steep vegetated bank behind. Sand and coarser sediments/debris on bank overlying silty/clayey sediment layer at foot of bank
N/A	10/7/2002	N/A	N/A	Bank south of Fred Devine Salvage Pier.	No seeps observed	N/A	Steep riprap bank. Clayey shelf at base of rip rap.
6/7	10/7/2002	7633213.391	701937.3377	North end of beach at south end of Coast Guard docks, Swan Island Lagoon	Linear discharge along ~10 - 15' approximately 8 - 10' up the beach. Discharge occurring on top of clayey material at interface between sand and clay. Rill development occurring along length of seep. iron (ferric hydroxide) staining at point locations. Seepage occurring below high tide level.	2	Sand beach over clayey/silty soil near base of beach. Short steep embankment behind the beach.
N/A	10/7/2002	N/A	N/A	Bank on north side of Swan Island Lagoon	No seeps observed	N/A	Cobbles and cobble/boulder rip rap bank
8/9	10/7/2002	7632009.637	701620.21	Bank on north side of Swan Island Lagoon. South of Beach No. 07B023.	Rills formed by rivulets discharging at base of cobble/boulder bank materials. Discharge estimated 1 - 2 gpm. Seepage originates above high tide level	1	Cobbles and boulders lining steep bank above small, sandy beaches at base. RR tracks approximately 20' above head of beach.
N/A	10/7/2002	N/A	N/A	Between Swan Island lagoon and Chevron Pipeline under river	No seeps observed	N/A	Asphalt, concrete slab, gravel and rip rap lining steep embankment.

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		X Ironet	Y Ironet				
10	10/7/2002	N/A	N/A	Riedel site - beach	Iron (ferric hydroxide) staining on beach cobbles over 10' stretch of beach. Area is dry - possible seasonal seep. Area is above high tide level	5	Cobble beach
N/A	10/7/2002	N/A	N/A	McCormick & Baxter Superfund Site	No seeps observed	N/A	Riprap up to sand and sand/gravel beach. Steep, short bank above beach
N/A	10/7/2002	N/A	N/A	McCormick & Baxter Superfund Site to RR bridge	No seeps observed. Submerged seeps of NAPL reported in this area by EPA	N/A	Sand beach up to near RR bridge - riprap under RR bridge
11	10/7/2002	7627314.972	705337.4579	Adjacent to Beach No. 06B022. McCormick & Baxter Superfund Site on south side of Willamette Cove.	Approximately 70+' of bank with containment booms. Hydrocarbon smear zone visible across tidal fluctuation zone on bank. No apparent seepage above river level.	4	Sand with gravel beach below riprap embankment.
N/A	10/7/2002	N/A	N/A	Willamette Cove to south of BES WQ lab (along Crawford St Corp site)	No seeps observed	N/A	Beach north of wooden hulk in cove is covered by rip rap
N/A	10/7/2002	N/A	N/A	South of BES WQ lab to Cathedral Park	No seeps observed	N/A	Sandy beach south of BES lab. Beach and embankment comprised of riprap and rocks north of BES lab up to Cathedral Park
12	10/7/2002	N/A	N/A	Beach No. 005B018. Under St Johns Bridge at Cathedral Park	Linear discharge near base of beach sand and over the top of underlying clay. Some rill formation in the sand from discharge. Seepage below high tide level	2	Gently sloping beach comprised mostly of sand, which overlies a shelf of clayey soil that is exposed mostly below the high tidal level.
N/A	10/7/2002	N/A	N/A	Mar Com Marine	No seeps observed	N/A	Gravel and debris over sand and clayey soil.
N/A	10/7/2002	N/A	N/A	Toyota area	No seeps observed	N/A	Riprap and wood pile wall with fill behind the retaining structures
13	10/7/2002	7620487.316	713186.3491	Terminal 4, Slip 3	Historical diesel seep through cobble riprap. No visible indications of discharge of water or diesel product observed during the survey. Seep location below high tide level.	4	Steep bank with cobble rip rap
N/A	10/7/2002	N/A	N/A	North side of Terminal 4, Slip 3	No seeps observed	N/A	Sandy beach
14	10/7/2002	7620351.817	714583.9252	Terminal 4, Slip 1	Seepage at east end of slip. Diffuse linear seepage with several point discharges (estimated 1 - 2 gpm). Iron (ferric hydroxide) staining at point discharges. Thick, healthy vegetation, including cattails along seep line. Seepage above high tide level.	1	Short steep embankment above shelf of fine-grained soil (silt/clay) behind partially demolished wood retaining wall. Sand beach in front of remainder of retaining wall. Thick green vegetation on fine-grained soil along seep line.

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Lower Willamette Group, Portland, Oregon

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
N/A	10/7/2002	N/A	N/A	Terminal 4, Slip 2	Concrete outfall - water seeping between outfall fill and concrete abutment.	N/A	Silty/clayey bank material next to water with steep bank above and back from the water line. Fill and concrete abutment around the outfall
N/A	10/7/2002	N/A	N/A	Bank between Terminal 4 and International Terminal basin	No seeps observed	N/A	Riprap bank. Rock and concrete debris along north side of bank south of basin. Numerous drain outfalls (24" corrugated metal and 8 - 10" PVC) protrude from bank
15	10/7/2002	7619902.196	717027.7348	East end of International Terminal basin adjacent to Schnitzer Investment Property.	Possible seepage in backfill next to outfall. Iron (ferric hydroxide) staining and iron bacteria slime surrounding outfall. Seepage above high tide level.	3	Steep riprap bank on south side of basin next to the outfall.
16	10/7/2002	7619963.525	717026.3675	East end of International Terminal basin adjacent to Schnitzer Investment Property.	Seepage with iron (ferric hydroxide) staining and iron bacteria slime at the base of the steep bank and above beach next to outfall.	1	East end consists of a short, steep bank behind and over a shelf of silty/clayey soil above the beach front.
17 - 19	10/7/2002	7619988.1120	717234.7558	East end of International Terminal basin adjacent to Schnitzer Investment Property.	Seepage with iron (ferric hydroxide) staining and iron bacteria slime at the base of the steep bank and above beach along the length of the east end of the basin. Cattails and other phreatophytes present along the seepage line. Small stream (estimated 5+ gpm) coming from the north end of the bank. The source of the stream is obscured by thick vegetation. The sides and base of the stream are stained with iron (ferric hydroxide). The majority of seepage occurs above the high tide level.	1, 2	Short, steep bank behind a shelf of silty/clayey soil above the beach front.
20	10/7/2002	7620006.949	717072.7766	East end of International Terminal basin adjacent to Schnitzer Investment Property.	Same as photos 17 - 20	1	Short, steep bank behind and over a shelf of silty/clayey soil above the beach front.
21	10/7/2002	7619566.775	717314.8483	North side of International Terminal basin adjacent to Burgard Industrial Park (Schnitzer Investment Property). Smurfit just inland	Water seeping from bank at transition from higher silt content to underlying higher clay content soils. Water also seeping from several holes in the bank. Seepage mostly above high tide level.	1	Thinly bedded clayey and silty soils on bank from east end to near west end of basin. Bank is covered with cobble and boulder rip rap at the west end of the basin near the river channel.
N/A	10/7/2002	N/A	N/A	River bank next to Schnitzer Investment Property (Premier Edible Oils) site	No seeps observed	N/A	Sand with some gravel and cobble patches on the beach. Concrete debris and fill along bank behind the beach

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		X Ironet	Y Ironet				
N/A	10/7/2002	N/A	N/A	River bank next to Premier Edible Oils	No seeps observed	N/A	Sand with gravel beaches
N/A	10/7/2002	N/A	N/A	River bank next to Time Oil	No seeps observed	N/A	Sand beach with gravel and cobble patches at base of embankment of concrete debris and fill.
N/A	10/7/2002	N/A	N/A	River bank north of Time Oil up to Fort James/Port of Portland	No seeps observed	N/A	Sand beaches with cobble and boulder riprap embankments next to Fort James and Port of Portland
22/23	10/7/2002	7616913.762	721217.4137	Next to Ash Grove Cement Site	Diffuse seepage along 5' length above clayey soil at base of steep bank. Water reinfilters into sand on beach where sand is sufficiently thick. Seepage above high tide level.	1	Steep bank above beach. Upper part of beach is silty/clayey soil, which is overlain by rock to the south and sand to the north. The rock on the beach has iron (ferric hydroxide) staining (Photo 22).
24	10/7/2002	7616816.65	721702.1184	North side of Ash Grove Cement pier.	Linear seeps where silty/clayey soil crops out below overlying gravel and cobbles. Water seeps into river through rock except where fine-grained soils crop out. Iron (ferric hydroxide staining) of rock along beach line. Seepage above and below high tide level.	2	Steep bank above beach. Upper part of beach is silty/clayey soil, which is overlain by rock. The silty/clayey soil crops out in places near the water line.
25	10/7/2002	7617031.454	722906.8144	Next to J.R. Simplot Facility	Linear seeps at base of the beach near the water line where silty/clayey soil crops out below overlying sand. Seepage below high tide level.	2	Steep bank above beach. Beach is sand overlying silty/clayey soil.
N/A	10/7/2002	N/A	N/A	Next to Oregon Steel facility	No seeps observed	N/A	Bank armored with cobble/boulder riprap. Steep 6 to 8' escarpment behind the beach comprised of silty/clayey soil.
26	10/7/2002	7615493.863	718327.6195	Beach No. 003B031. Next to PGE Harborton Site	Linear seepage at base of 6' high embankment behind beach. Seep line marked by vegetation on bank and damp soil. Seepage originates mostly above high tide level.	1	Clayey soils underlying beach sand
N/A	10/7/2002	N/A	N/A	Next to Georgia Pacific Site	No seeps observed	N/A	Cobble and boulder riprap embankment
27	10/7/2002	7616413.1981	716421.3695	Beach No. 03B033. South side of Trumbull Asphalt site	Iron (ferric hydroxide) staining of riprap at two locations along approximately 20' of bank above daily high water down to the river level. Possible seasonal seep. No visible discharge. Staining above high tide level.	5	Cobble and boulder riprap embankment with sandy beach at far south end of site.

Table 1

Seep Survey Summary for River Mile 2 to 10.5

Portland Harbor Sediment RI/FS

Lower Willamette Group, Portland, Oregon

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
28	10/7/2002	7616465.24	716328.2064	Beach No. 03B033. South side of Trumbull Asphalt site	Iron (ferric hydroxide) staining of riprap at two locations along approximately 20' of bank above daily high water down to the river level. Possible seasonal seep. No visible discharge. Staining above high tide level.	5	Cobble and boulder riprap embankment with some sand on the beach at far south end of site.
N/A	10/7/2002	N/A	N/A	Beach No. 03B033. South end of Trumbull Asphalt	No seeps observed	N/A	Small sand beaches with a dense band of healthy vegetation near the head of the beach.
29	10/7/2002	7616987.472	714851.7226	Beach No. 03B033. Adjacent to GATX Linnton Facility	Iron (ferric hydroxide) staining of concrete retaining wall above beach. Staining below drain pipe and along seam between vertical and sloped wall. Possible seasonal seep along seam. No visible discharge. Staining above high tide level.	5	Concrete retaining wall above beach and steep riprap bank above narrow sandy beach with fine-grained soils underlying the sand.
30	10/7/2002	7617244.954	714416.1246	South end of GATX pier. North of Beach No. 004B024.	Iron (ferric hydroxide) staining on beach. Containment and sorbent booms around stained area but no apparent sheen observed. Area below high tide level.	5	Timbered seawall behind a narrow rocky beach
N/A	10/7/2002	N/A	N/A	North of GATX Linnton and south of Linnton Plywood	No seeps observed	N/A	Sand beach at base of steep bank. Thick line of vegetation at the base of the bank and head of beach
31 - 33	10/7/2002	7618819.176	711335.3725	ARCO facility. Adjacent to south end of Beach No. 04B027.	Numerous cracks in seawall with iron (ferric hydroxide) staining. Possible seasonal seeps along cracks in seawall. Stained areas above high tide level.	5	Concrete seawall. Seawall is vertical at the top and sloped at bottom. Seawall overlies narrow rocky and sandy beach with fine-grained sediments underlying coarse materials.
34/35	10/7/2002	7619407.437	710381.0836	Mobil Facility	Cracks in seawall with iron (ferric hydroxide) staining around cracks near base of wall. Staining above and below high tide level.	5	Concrete seawall. Seawall is vertical at the top and sloped at bottom. Seawall overlies narrow rocky and sandy beach with fine-grained sediments underlying coarse materials.
36	10/7/2002	7619467.003	710180.866	South end of Mobil Facility pier	Square wood outfall with iron (ferric hydroxide) staining and slime. Estimated 5+ gpm discharging from pipe. Staining above and below high tide level.	3, 5	Steep embankment covered with cobble and boulder riprap and debris.
N/A	10/7/2002	N/A	N/A	Next to Time Oil	No seeps observed	N/A	Steep riprap bank
N/A	10/7/2002	N/A	N/A	Foss Tug	No seeps observed	N/A	Riprap bank next to and south of Foss.
N/A	10/8/2002	N/A	N/A	Marine Finance	No seeps observed	N/A	Concrete rubble and rock riprap. Wood retaining wall just south of dolphins.
N/A	10/8/2002	N/A	N/A	US Moorings	No seeps observed	N/A	Steep riprap slope above gravel beach in small inlet. Steep slope with concrete and boulder riprap down to water. Riprap retained by wood post piles at water line.

Table 1
Seep Survey Summary for River Mile 2 to 10.5
Portland Harbor Sediment RI/FS
Lower Willamette Group, Portland, Oregon

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
37	10/8/2002	7623800.097	705742.4885	South side of Beach No. 06B025 on south side of Gasco pier	Iron (ferric hydroxide) staining across 20 to 25' length of rock overlying fine-grained beach. Another point source of iron (ferric hydroxide) staining at the south end of Gasco, just to the south of the pipeline pier. Staining mostly above high tide level.	5	Fine-grained sediment at toe of beach with cobbles overlying the fine-grained material up to the head of the beach and toe of the embankment. Embankment comprised of riprap and debris.
N/A	10/8/2002	N/A	N/A	Wacker Siltronic	No seeps observed	N/A	Small beach at base of ramp structure. Steep bank with boulder-size rip rap behind sandy beach. Several patches of narrow sandy beaches below the high tidal water mark.
38 - 40	10/8/2002	7626406.776	703928.7535	Beach No. 07B024. BNSF railroad bridge	Iron (ferric hydroxide) staining around COPoutfall No. 22C. Some seepage from granular backfill under concrete pipe footing observed. Seepage above high tide level.	3	Broad beach under and south of bridge with short, steep, heavily-vegetated bank behind the beach. Beach is comprised of sand over silty and clayey soil. There is a small stream incised through the sand and into the underlying fine-grained soil. Steel pipes buried in the fine-grained soil are exposed along the stream. The source of the stream is obscured, but appears to be a culvert through the road embankment behind the beach. Large concrete outfall (COPoutfall No. 22C) located under the bridge.
N/A	10/8/2002	N/A	N/A	North end of Atofina	No seeps observed	N/A	Sand beach with abundant concrete debris at base of a rip rap armored slope above the beach.
N/A	10/8/2002	N/A	N/A	Sand beach next to north side of north Atofina dock. Atofina outfall next to north side of pier	No seeps observed	N/A	Sand beach with some silty/clayey soil exposed at base of beach under the sand near the outfall.
N/A	10/8/2002	N/A	N/A	South of North dock	No seeps observed	N/A	Beach is rocky with debris south of north pier and becomes an embankment down to the water
N/A	10/8/2002	N/A	N/A	Middle Atofina dock	No seeps observed	N/A	North side of dock: sand beach with two outfalls. Northern outfall filled with sand. South Side: steep rock and concrete debris bank over sand beach with little of the beach exposed above the water line.

Table 1
Seep Survey Summary for River Mile 2 to 10.5
Portland Harbor Sediment RI/FS
Lower Willamette Group, Portland, Oregon

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
41	10/8/2002	N/A	N/A	Beach No. 07B022. North side of Willbridge basin adjacent to GS Roofing (Genstar)	Water discharges from a line seep at the foot of the sand line above clay soil at the foot of the beach.	2	Broad arcuate sandy beach over clayey soil with overlooking bluff. Saltzman Creek drainage is present next to embankment on north side. The creek flows through deep drainage and out into flats in the embayment. Several pipes daylight in the drainage from below Genstar Roofing site. Fine-grained soil exposed at the head of the beach and below outfall
42	10/8/2002	7628584.092	700634.9426	South end of Beach No. 07B022. Willbridge - between GATX and Chevron docks	Water discharging through boulders above rocky beach. iron (ferric hydroxide) staining and slime on beach. Private outfall next to north side of Chevron dock also discharging estimated 5 gpm with some iron (ferric hydroxide) staining. Seepage mostly above high tide level.	1(?), 3 (?)	Boulder riprap above beach. Beach is gravel and cobbles over silt/clay soil.
43 - 45	10/8/2002	7628863.085	700342.6222	Willbridge - between Chevron and Conoco/Phillips docks	Seep at base of riprap bank on top of fine-grained beach. iron (ferric hydroxide) staining, petroleum staining and algae growth observed. Clean sorbent boom around seep. Location of historical petroleum seepage. Seepage source mostly above high tide level.	1(?), 3 (?)	Riprap bank above silty/clay beach. Cutoff wall above seep. Chevron groundwater remediation measures visible behind seep.
46	10/8/2002	7629084.531	700059.1746	Willbridge - South side of Conoco/Phillips pier	COP outfall 22. Containment booms surround beach below the outfall pipe. Location of historical petroleum seepage.	3, 4	Arcuate sandy beach with outfall at foot of bank above beach. Beach is protected with rock armor below outlet of pipe. Fine-grained silty/clayey soil exposed at base of sand beach. Two private outfalls present on south side of beach. Sides of beach lined with riprap. Conoco/Phillips recovery wells and slurry wall above and adjacent to outfall.
N/A	10/8/2002	N/A	N/A	South end of Willbridge - near McCall/Great Western	No seeps observed	N/A	Steep bank covered with riprap down to the water line. Shallow sandy bottom below water line.
N/A	10/8/2002	N/A	N/A	LP Glacier next to south side of McCall Beach - former Oregon Steel Site	No seeps observed	N/A	Sand beach with gravel and boulders below a steep embankment. The embankment is composed of metal slag, cemented cinders and debris. Beach stretches south of Tube Forgings dock. Some moss and healthy vegetation present at base of embankment behind beach.

Table 1
Seep Survey Summary for River Mile 2 to 10.5
Portland Harbor Sediment RI/FS
Lower Willamette Group, Portland, Oregon

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
47	10/8/2002	7631304.004	698363.9517	Basin at south end of Tube Forgings	Seepage at base of embankment on top of silty flats. Observed seepage below high tide level.	1	Rock and debris embankment above silty/clayey soil beach (mudflat).
N/A	10/8/2002	N/A	N/A	Lakeside Industries	No seeps observed	N/A	Small sand beach at base of Lakeside Industries pier.
N/A	10/8/2002	N/A	N/A	Between Lakeside and Gunderson	No seeps observed	N/A	Debris jetty and riprap bank
48	10/8/2002	7633306.83	696776.4129	Gunderson	COP outfall 18 under Gunderson facility. Estimated 1 gpm of seepage around backfill on south side of outfall. Source of seepage unknown but suspected to be further up embankment (BES staff pers. comm. , 2003). Estimated 10 gpm of discharge of clear water from outfall. iron (ferric hydroxide) staining on rock at outlet with heavy algae growth. Seepage above high tide level.	3	COP outfall 18 at base of steep embankment and wall below Gunderson. Sandy and silt beach over clayey soil at base of outfall. The sand on the lower portion of the beach tends to be saturated.
49	10/8/2002	7639889.856	694618.8842	North side of Goldendale Aluminum Dock. South of Beach No. 09B027.	Corroded corrugated metal pipe protruding from bank above beach. Estimated 5 gpm of clear water discharging from pipe. Heavy iron (ferric hydroxide) staining on pipe and on rocks surrounding pipe. Potential seepage around backfill of pipe. Seepage above high tide level.	3	Rock and concrete debris bank over narrow sand beach
N/A	10/8/2002	N/A	N/A	North end of UPRR Albina Railyard	No seeps observed	N/A	Gravel and sand beach with rocky embankment
N/A	10/8/2002	N/A	N/A	Port O Call Restaurant	No seeps observed	N/A	Riprap bank
N/A	10/8/2002	N/A	N/A	Freightliner site north of Port O Call Restaurant	No seeps observed	N/A	Sand and gravel beach
50	10/8/2002	7634148.463	698465.4209	South end of Cascade Shipyard	Seep at base of bank over silty/clay soil at base. Linear seep along 20' length approximately 3' wide above rocky beach. Seepage above high tide level.	1	Steep embankment over silty soil which is present at the back of and above a rocky beach.
N/A	10/8/2002	N/A	N/A	Cascade Shipyard	No seeps observed	N/A	Dock on pilings
N/A	10/8/2002	N/A	N/A	North end of Cascade Shipyard	No seeps observed	N/A	Cobble and boulder riprap bank
N/A	10/8/2002	N/A	N/A	East side of shipyard in basin between yard and pier	No seeps observed	N/A	Cobble and boulder riprap bank

Table 1**Seep Survey Summary for River Mile 2 to 10.5****Portland Harbor Sediment RI/FS****Lower Willamette Group, Portland, Oregon**

Photo Number	Date of Observation	GPS Location (Oregon State Plane North Coordinates)		General Location	Seep Description/Comments	Seep Category (See Section 3.0 of Memorandum)	Characteristics of Bank
		X Ironet	Y Ironet				
N/A	10/8/2002	N/A	N/A	East side of Swan Island in basin	No seeps observed	N/A	Rock and debris fill behind wood pilings and low plank walls Many corrugated drains at the top of the bank on 50 to 100' intervals.
N/A	10/8/2002	N/A	N/A	South end of basin on east side of Swan Island	No seeps observed	N/A	Rock and debris bank with pilings and wood retaining wall near base

Notes:

Seep Category = See Section 3.0 of Seep Memo

N/A = Not Applicable - No seep was observed so no photos or GPS coordinates were obtained



Groundwater Solutions Inc.

LWG
LOWER WILLAMETTE GROUP

FEATURE SOURCES:
Transportation, Water, Property, Zoning or Boundaries: Metro RLIS.
Channel & River miles: Developed from US Army Corps of Engineers information.
River Edge: Created by heads-up digitizing from the October 2001 0.33 ft resolution color orthophotos. Photo Locations and GPS Navigation Points: Digital photos taken by Striplin Environmental on October 7 & 8, 2002 and locations from GPS operated by Fishman Environmental.

Map Revision Date: Tuesday, January 21, 2003

File Name: seepphotos_beach.mxd

Legend

- 36 Photo Locations and Photo Number
- GPS Navigation Points
- Environmental Site Cleanup Inventory Sites
- Beach locations evaluated for Human Health Risk near or at the location where seeps were observed.

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Figure 1
Seep Survey
Observation Points

Attachment A

Seep Reconnaissance Survey Photos

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Photo 1: East side of Swan Island Lagoon. Linear seep characterized by sheetflow where fine-grained sediment crops out at the base of the sand. Iron oxide staining and slime associated with seepage on the upper part of the beach above main seep line.



Photo 2: Beach on east side of Swan Island Lagoon. Linear seep at base of beach where fine-grained sediment crops out. Seep is incised by rills due to discharge from steep bank behind beach.



Photo 3: Pier at east side of Swan Island Lagoon. Linear seep line approximately 10 feet long characterized by sheetflow emerging at base of sand where fine-grained sediment crops out. Vegetation line along base of steep bank at head of beach.



Photo 4: Beach to south of Fred Devine Salvage pier. Linear seep line approximately 20 feet long characterized by sheetflow emerging from base of sand where fine-grained sediment crops out. Vegetation line along base of steep bank at head of beach.

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Photo 5: Closeup of beach to south of Fred Devine Salvage pier. Linear seep approximately 20 feet long characterized by sheetflow emerging from base of sand where fine-grained sediment crops out. Vegetation line at head of beach and base of steep bank.



Photo 6: Beach at south end of Coast Guard facility in the Swan Island Lagoon. Closeup of seep line approximately 15 feet long at base of sand where fine-grained sediment crops out. Rill development due to point discharges along seepage face. Some iron oxide staining at point discharge locations. Note vegetation line at base of embankment.



Photo 7: Beach at south end of Coast Guard facility in the Swan Island Lagoon. Distant perspective of seep shown in Photo 6.

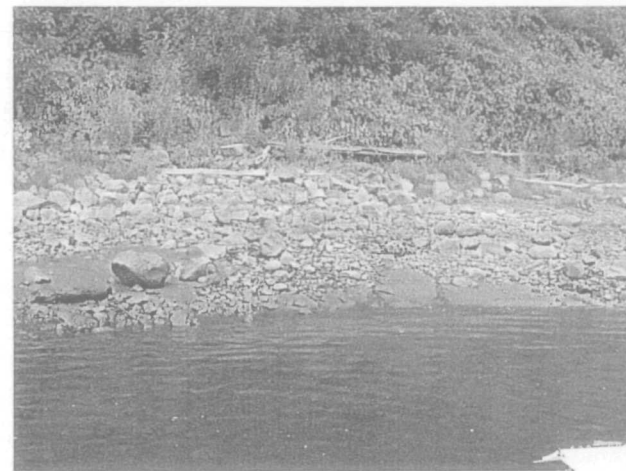


Photo 8: Bank on north side of Swan Island Lagoon. Rivulets from seep emerging beneath gravel and cobbles at base of steep embankment.

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Photo 9: Bank on north side of Swan Island Lagoon. Closeup of seep emerging beneath gravel and cobbles at base of steep embankment.



Photo 10: Riedel/Triangle Park, LLC Site. Possible seasonal seep where iron oxide staining is present on beach cobbles present at the base of the embankment.

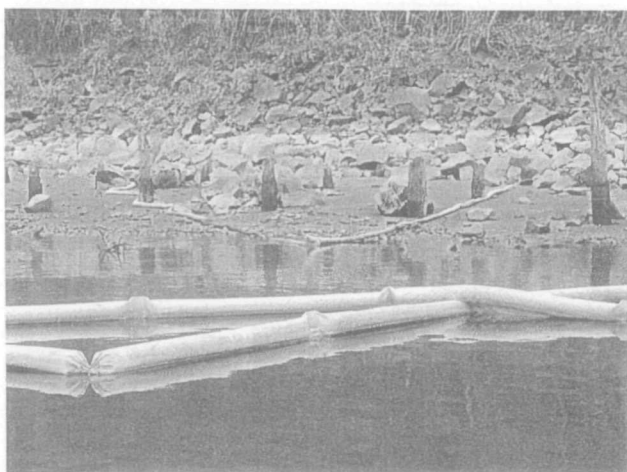


Photo 11: McCormick & Baxter Superfund Site on south side of Willamette Cove. Hydrocarbon smear across tidal fluctuation zone on beach. No visible discharge of water above the river level was observed during the survey.



Photo 12: Cathedral Park under St. Johns Bridge. Sheetflow from linear seep discharging at base of sand where underlying fine-grained soil crops out.

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Photo 13: Terminal 4, Slip 3. Containment boom for fuel oil seep. No seepage of water or petroleum observed during the survey.



Photo 14: East end of Terminal 4, Slip 1. Diffuse linear seepage at base of embankment above beach. Seep marked by vegetation line. Several point discharges (Est. 1 – 2 gpm) from seep line characterized by iron oxide staining and iron bacteria slime.



Photo 15: East end of International Terminal next to Schnitzer Site. Discharge from outfall and around backfill. Iron oxide staining and iron bacteria slime buildup.



Photo 16: East end of International Terminal next to Schnitzer Site. Seepage at base of steep bank and retaining structures above beach next to outfall. Seepage marked by iron oxide staining and iron bacteria slime.

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Photo 17: East end of International Terminal next to Schnitzer Site. Seepage at base of steep bank and retaining structures above beach next to outfall. Seepage marked by iron oxide staining and iron bacteria slime.



Photo 18: East end of International Terminal next to Schnitzer Site. Seepage at base of embankment at top of beach. Rivulet (Est. 5 gpm) flowing from thick vegetation at base of embankment. Iron oxide staining and bacterial slime growth evident.

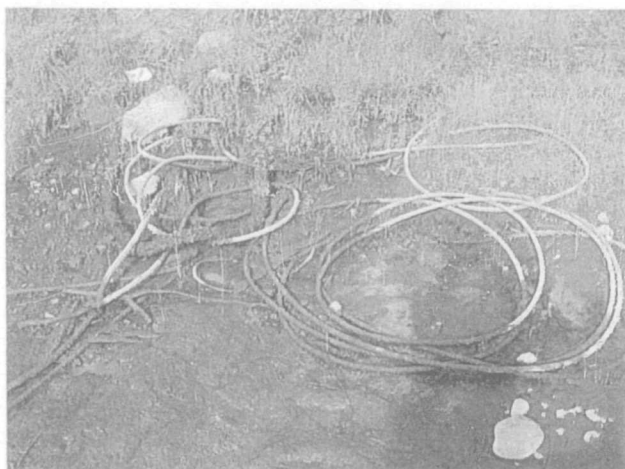


Photo 19: East end of International Terminal. Seepage at base of embankment at top of beach. Seepage marked by moss and some iron oxide staining.



Photo 20: East end of International Terminal. Seepage from base of embankment above beach. Some seepage and iron oxide staining around outfall. Seep line at base of embankment marked by heavy vegetation.

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Photo 21: North side of International Terminal next to Smurfit. Seep line near base of embankment over a shelf of clayey sediment.



Photo 23: North side of Ash Grove Cement pier. Seepage line at base of embankment over fine-grained sediments forming the beach.

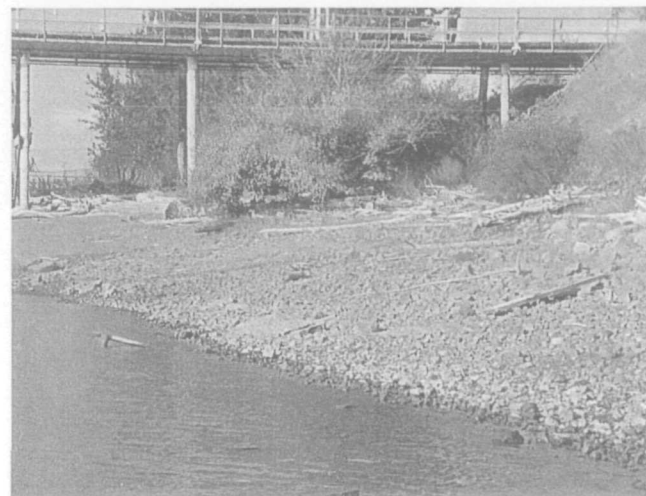


Photo 22: South side of Ash Grove Concrete pier. Iron oxide staining on beach cobbles. Vegetation at base of embankment may delineate seepage line.

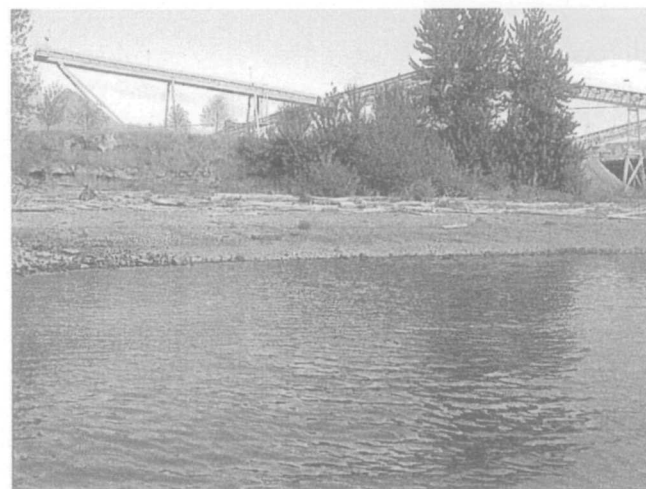


Photo 24: North side of Ash Grove Cement looking south. Linear seeps at base of the beach near the water line where fine-grained soil crops out below overlying granular materials. Iron oxide staining evident.

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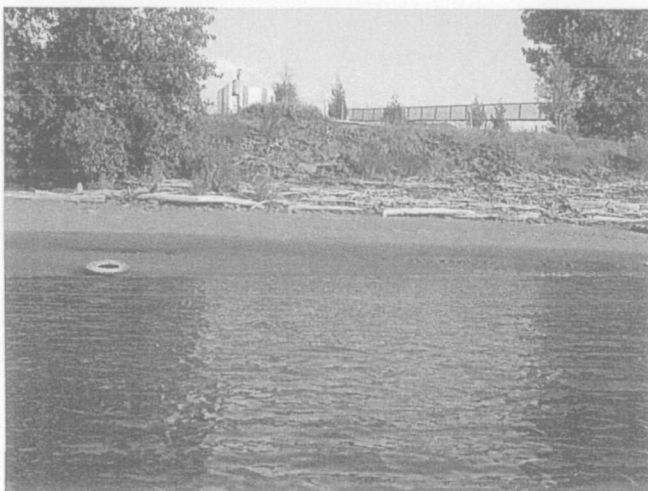


Photo 25: Simplot Site. Seepage line at base of sand where fine-grained sediment crops out.



Photo 26: Next to PGE Harborton facility. Seepage along base of embankment at head of the beach. Seepage forms rills that feed into small stream.

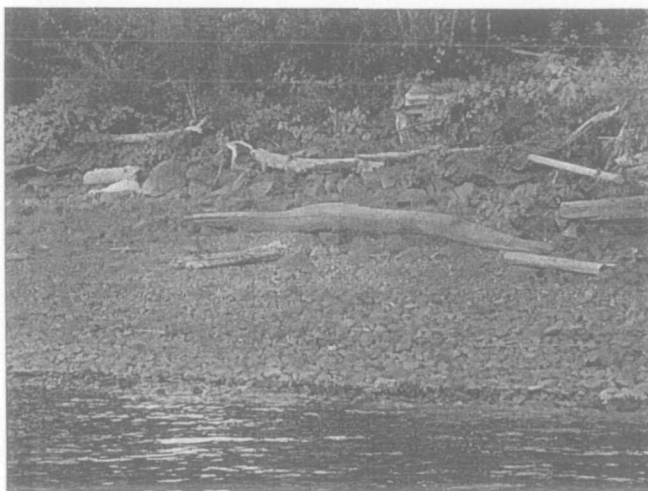


Photo 27: Owens Corning/Trumbull Asphalt site. Iron oxide staining of cobble-size riprap on steep embankment. No seepage directly observed.



Photo 28: Owens Corning/Trumbull Asphalt site. Iron oxide staining of approximately 20' of cobble riprap above sand beach. No seepage directly observed.

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Photo 29: GATX Linnton site. Iron oxide staining along seam at junction of vertical and sloped retaining walls. Moss growth along seams and cracks. Visible seepage from seams not observed.



Photo 30: South side of GATX Linnton pier. Iron oxide staining of beach at base of retaining wall. Containment and sorbent booms around stained area. No visible discharge or sheen observed.



Photo 31: North side of ARCO pier. Iron oxide staining emanating from cracks and seams in concrete retaining wall. Sandy and rocky beach at base of retaining wall. No visible seepage observed.



Photo 32: North side of ARCO pier looking south. Iron oxide staining emanating from cracks and seams in concrete retaining wall. Sandy and rocky beach at base of retaining wall. No visible seepage observed.

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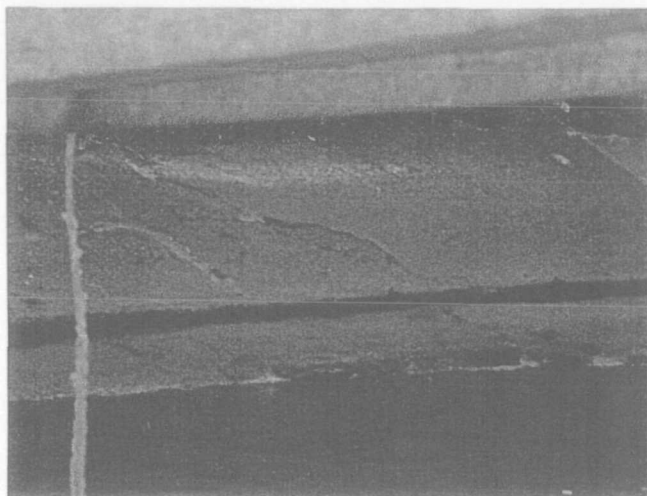


Photo 33: ARCO facility. Iron oxide staining emanating from cracks and seams on lower portion of concrete retaining wall above fine-grained sediments. No visible seepage observed.

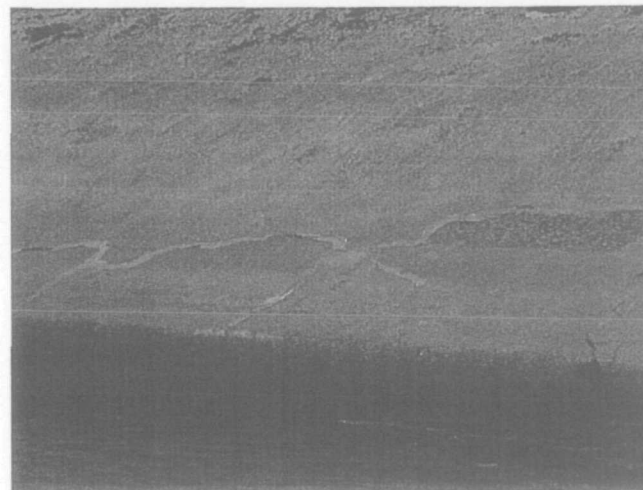


Photo 34: Mobil facility. Iron oxide staining emanating from cracks and seams on lower portion of concrete retaining wall. No visible seepage observed.

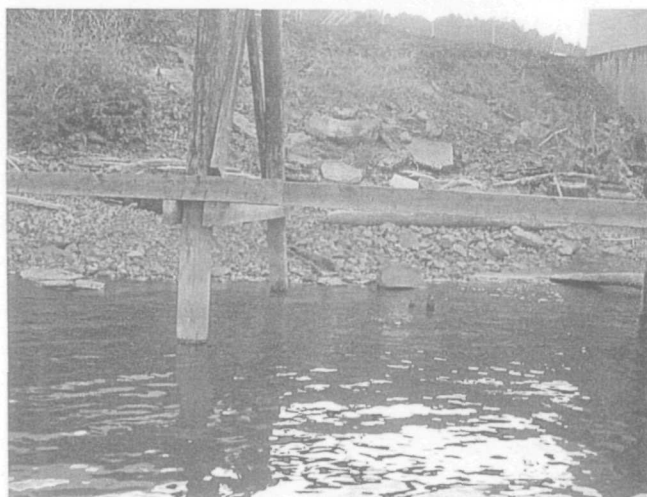


Photo 35: South end of Mobil facility. Wood plank outfall (Est. 5 gpm discharge). Iron oxide staining on cobble riprap over sandy beach adjacent to outfall. Riprap is damp and vegetated in vicinity of outfall

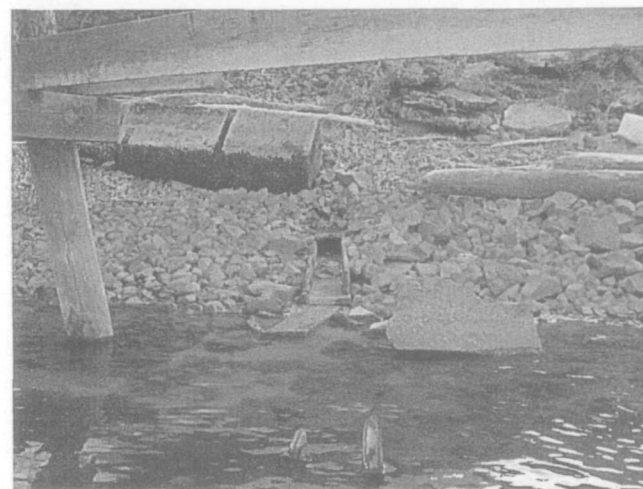


Photo 36: South end of Mobil facility. Closeup of wood plank outfall (Est. 5 gpm discharge). Iron oxide staining on cobble riprap over sandy beach adjacent to outfall. Damp and vegetated in vicinity of outfall.

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Photo 37: Adjacent to Gasco site south of pier. Iron oxide staining of rock overlying sand and mud. Apparent seepage evident at the foot of beach.



Photo 39: Beach under railroad bridge. Photo taken near the road embankment where the stream discharges onto the beach.



Photo 38: Beach under railroad bridge. Iron oxide staining and slime growth in stream emanating from steep overgrown bank at under south side of bridge. Source of stream likely a culvert under road.



Photo 40: Beach under railroad bridge. COP Outfall 22C located under the bridge. Seepage from backfill observed at base and on sides of outfall. Iron oxide staining and iron bacteria slime growth.

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Photo 41: Beach on north side of Willbridge basin. Seep line where fine-grained sediments crop out under the sand at the foot of the beach.



Photo 42: Chevron facility. Closeup of water discharging under boulder riprap. Iron oxide staining of boulders.



Photo 43: Chevron facility (between Conoco/Phillips and Chevron docks). Seep at base of riprap slope on silty/clayey beach. Iron oxide staining on riprap, moss growth and petroleum-like staining observed. No sheen observed.



Photo 44: Chevron facility (between Conoco/Phillips and Chevron docks). Same as Photo 43

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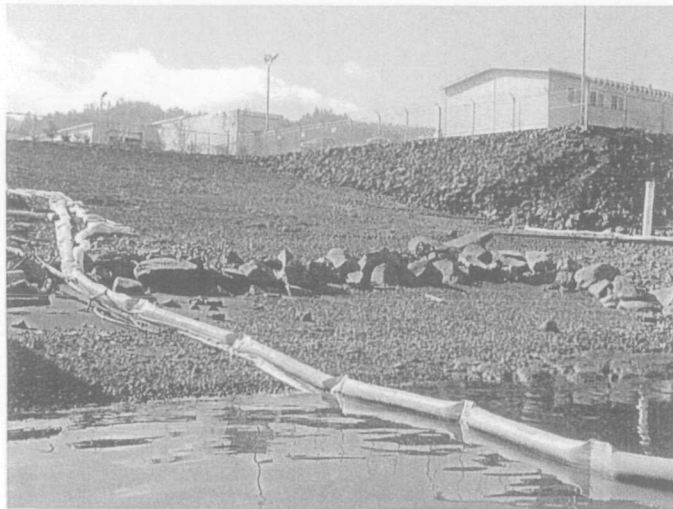


Photo 45: Chevron facility (between Conoco/Phillips and Chevron docks). Iron oxide staining of rock above beach. Remainder is same as photos 43 and 44.

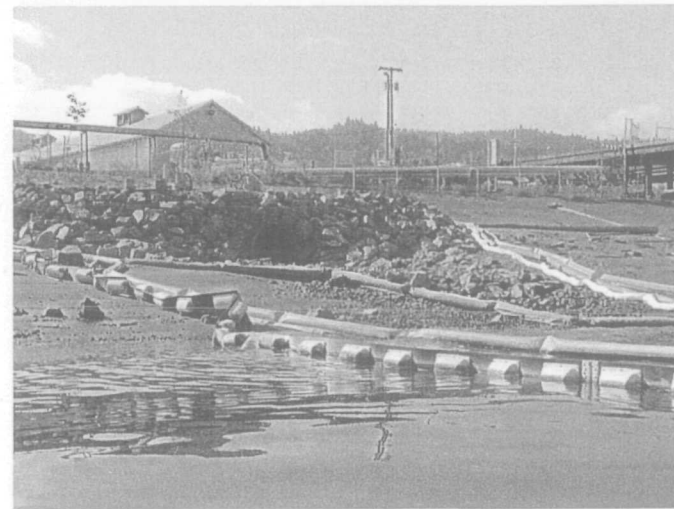


Photo 46: Conoco/Phillips facility (south side of Conoco/Phillips dock). Location of past groundwater seepage through backfill surrounding COP Outfall 22. Outfall surrounded by containment and sorbent booms. No seepage around outfall observed.



Photo 47: Tube Forgings facility. Seep line at base of embankment where fine-grained sediment crops out at the foot of the slope.



Photo 48: Gunderson facility. Apparent seepage adjacent to COP Outfall 18 (Est. 1 gpm). Source of seepage is uncertain.

Do Not Quote or Cite

This document is currently under review by US EPA and its federal, state and tribal partners, and is subject to change in whole or part

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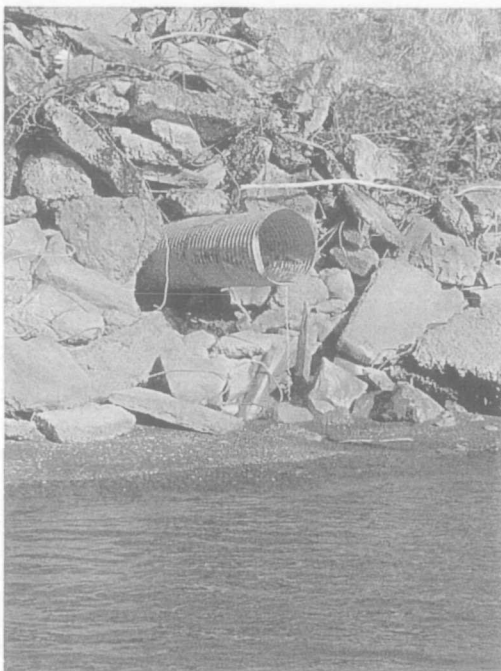


Photo 49: North end of Goldendale Aluminum facility. Heavily corroded steel outfall with iron oxide staining on concrete debris riprap surrounding outfall.



Photo 50: South end of Cascade Shipyard. Linear seep along 20' length above rocky beach. Seepage is at base of a steep embankment where fine-grained soil crops out.